



ASUSat Lab: ASUSat1, Three Corner Sat, and others

Michael Schoenoff
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Arizona State
University

<http://nasa.asu.edu>

Program Overview

Staffed entirely by students

usually 50 per semester

high school - Ph.D. (90% undergraduate)

engineering, science, business, liberal arts, social work,
communications

volunteer, paid intern, class credit

Responsible for all aspects of program, including:

- concept
- design
- fabrication
- integration
- testing
- launch support
- flight operations
- AND program management

Advisement by industry partners and university faculty

Outreach activities / diversity efforts

local schools (K-12), WISE, other minority programs

local community/professional groups

Projects of ASUSat Lab

Student Satellite Program

Helen Reed, Faculty Advisor

ASUSat1/AO-37 - Assi Friedman, Joel Rademacher

Since October 1993, over 400 students

6 kg nanosatellite

Minotaur launch January 26, 2000 - Vandenberg

Three Corner Sat - Mike Schoenoff, Lauren Egan

University Nanosat Program

ASU, Colorado, New Mexico State

Shuttle launch 2003

Moon Devils - Megan Gnagy

Moon Buggy Race every Spring since 1995

US Space & Rocket Center/NASA Marshall, Huntsville

April 13, 2002

AZeroG - Robyn Moskowitz

New students

Microgravity experiments/Three Corner Sat components

NASA's KC-135, March and July 2001, March 2002

CanSat - Darcy Allison

New students

Satellite class - beginning-to-end of project

next launch May 2002

Sub-SEM - Thom Kreider, Assi Friedman

2 Non-deploying payloads

NASA Wallops, June 18, 2000

Sounding Rocket

SEM -Denielle Burl

Science experiment - roots

Saguaro HS, Waggoner Elem, Mountain Ridge HS

STS 105, August 2001

ASUSat1 Highlights

13 lb (6 kg) nanosatellite
Carbon composite structure
Imaging payload

Vegetation indexing

Earth observation

Amateur Radio

Communications repeater

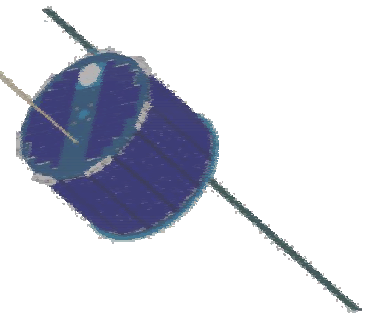
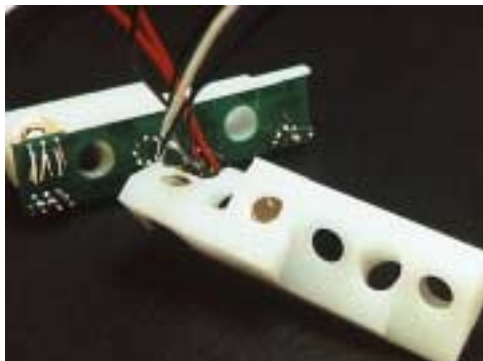
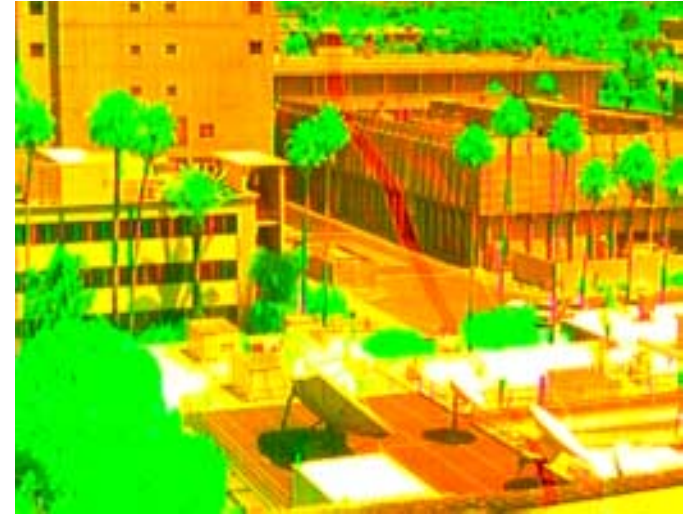
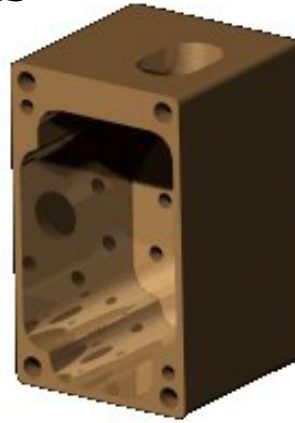
Many student designed/built components

Fluid damper

Gravity gradient boom

Sun/Earth sensor array

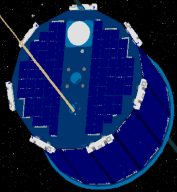
Thermal model verification/simulation



ASUSat1



Space Quest, Ltd.



Results

- Over 400 students: hands-on experience!
- Launched VAFB 1st OSP Jan 26, 2000
- Team communicated with and commanded spacecraft
- 15 hours of life on batteries
- Majority of components and subsystems performed as designed
- Designated AO-37



Three Corner Sat (3[^]Sat) University Nanosat Program

Arizona State University
University of Colorado at Boulder
New Mexico State University

Michael Schoenoff - Senior in
Mechanical Engineering at ASU
co-Project Leader/co-Systems Engineer

Lauren Egan - Junior in Chemical
Engineering at ASU
co-Project Leader/co-Systems Engineer
Safety/Configuration Management

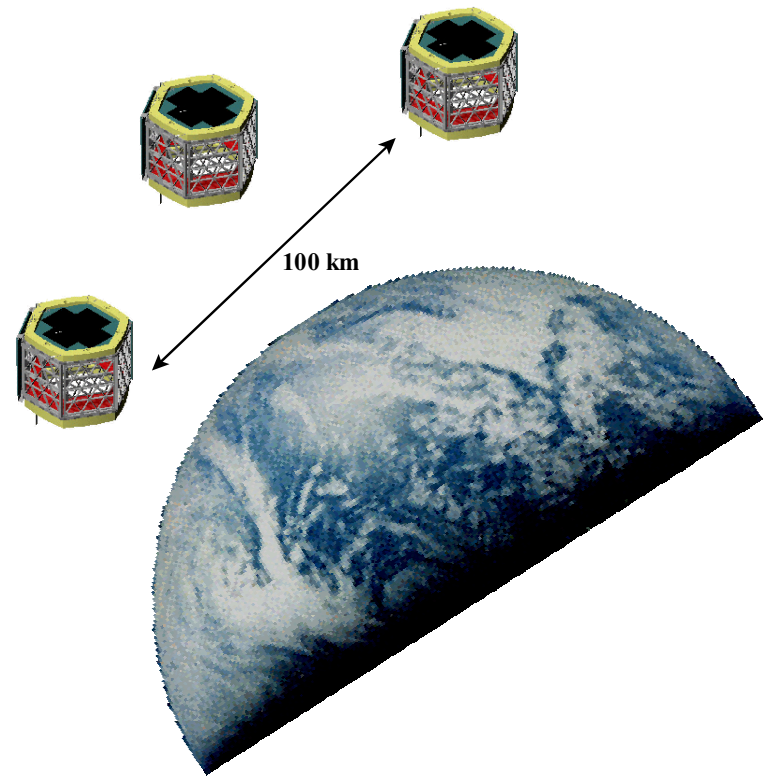
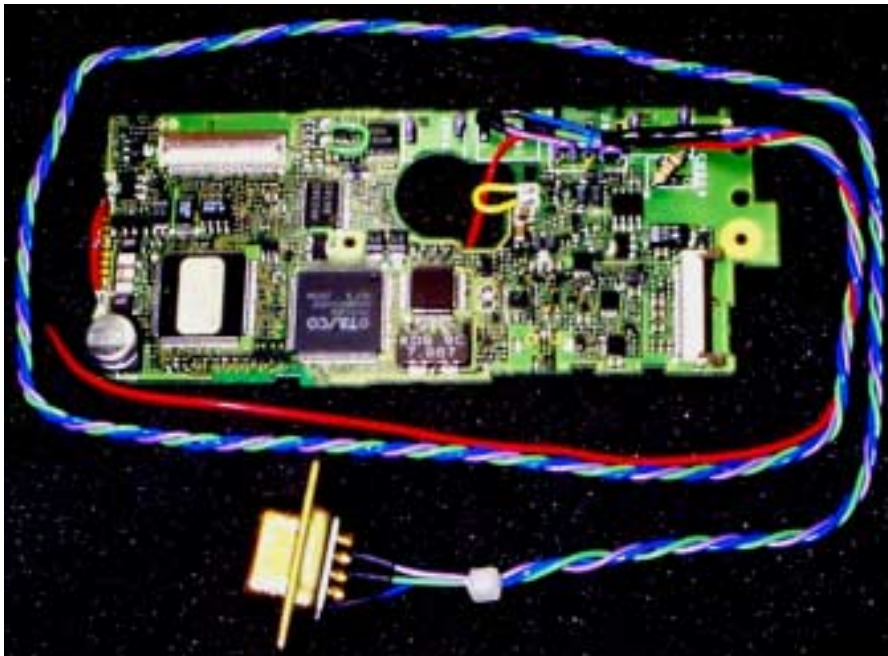


Project objectives for TechSat-21

- Inter-satellite Communications
- Virtual Formation Flying
- Distributed & Automated Operations
- Imaging
- Modular, Generic Design
- Micropropulsion Experiment
- Student Education



Inter-satellite Communication & Virtual Formation Flying



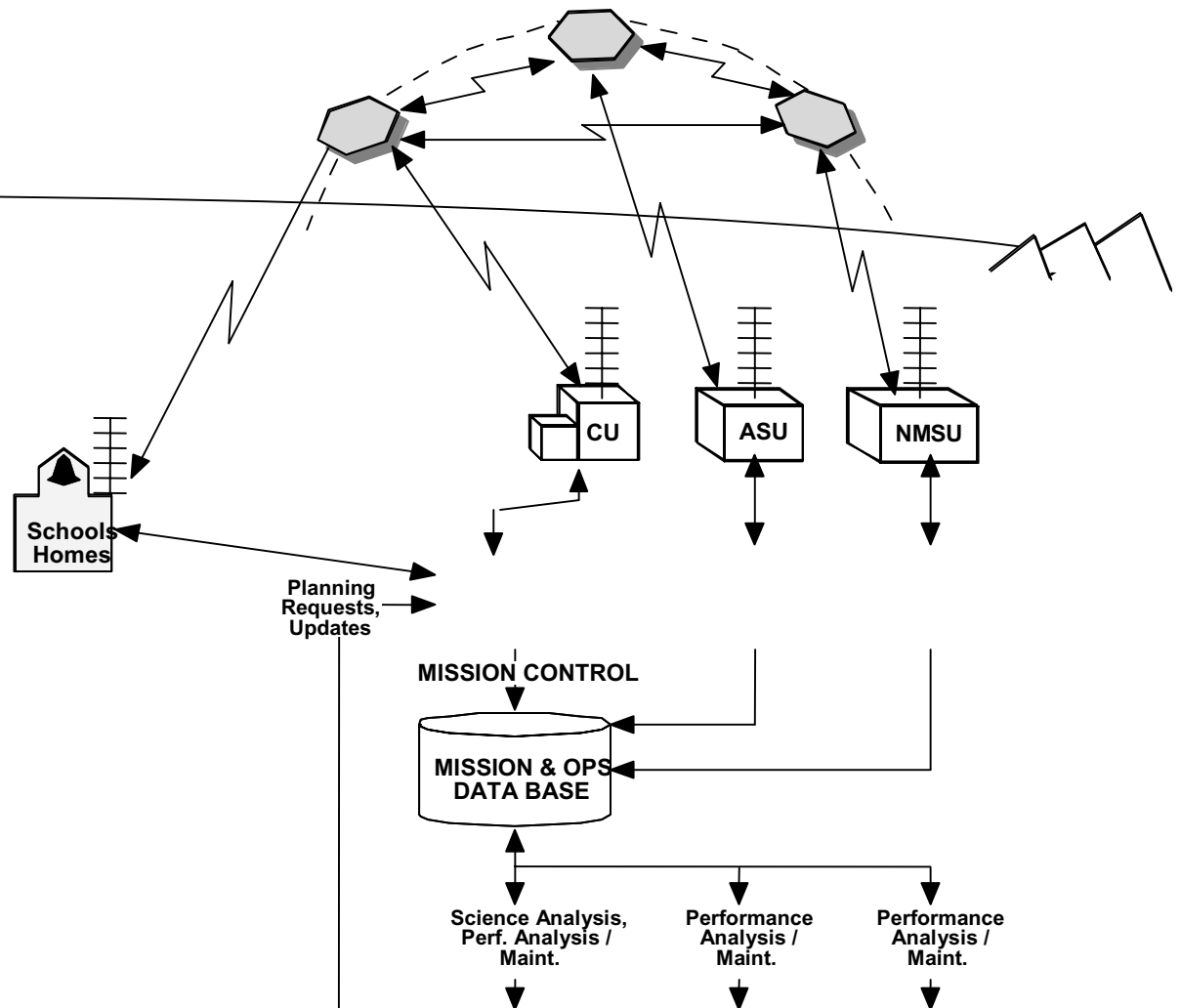
- Use packet radio techniques to relay position, status, control information over 100-km baseline

Distributed & Automated Operations

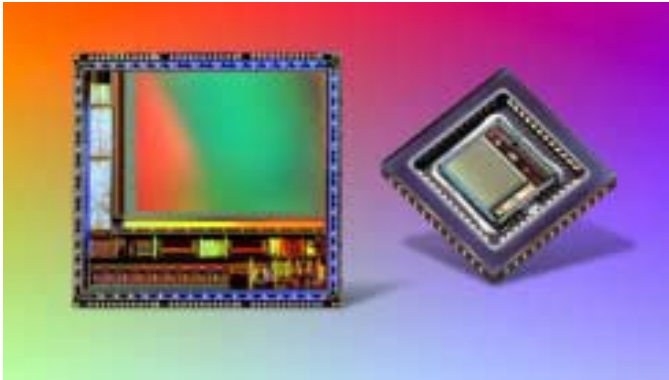
JPL decision- making
software - CASPER

Each satellite is
equally capable and
can function
independently or as
part of a network

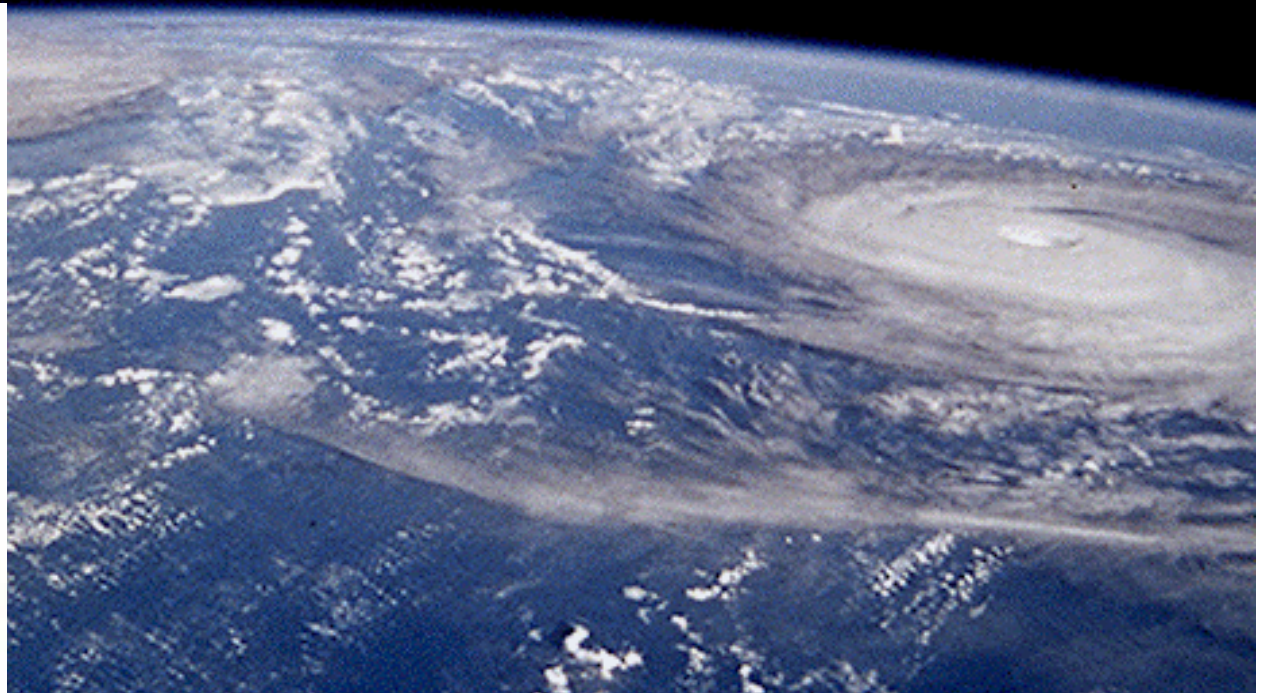
Ability to reconfigure
and pass command
and control to any of
the elements of the
system



Imaging

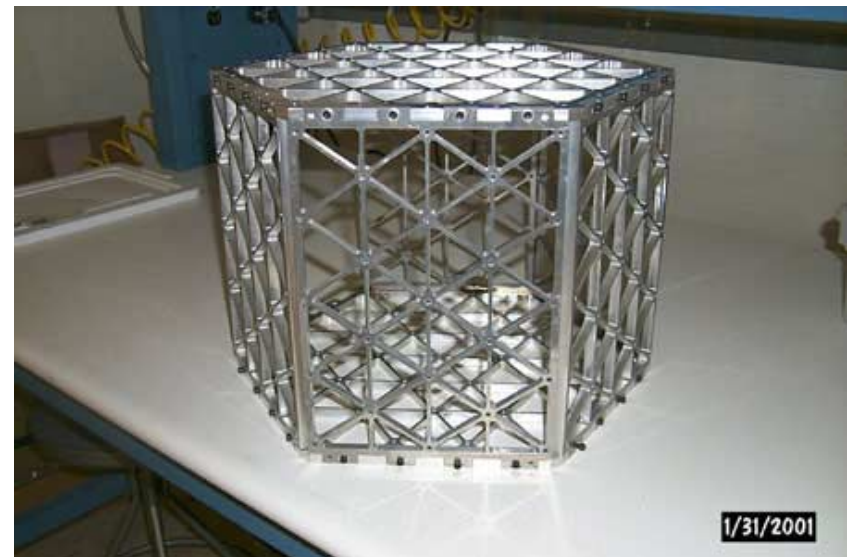
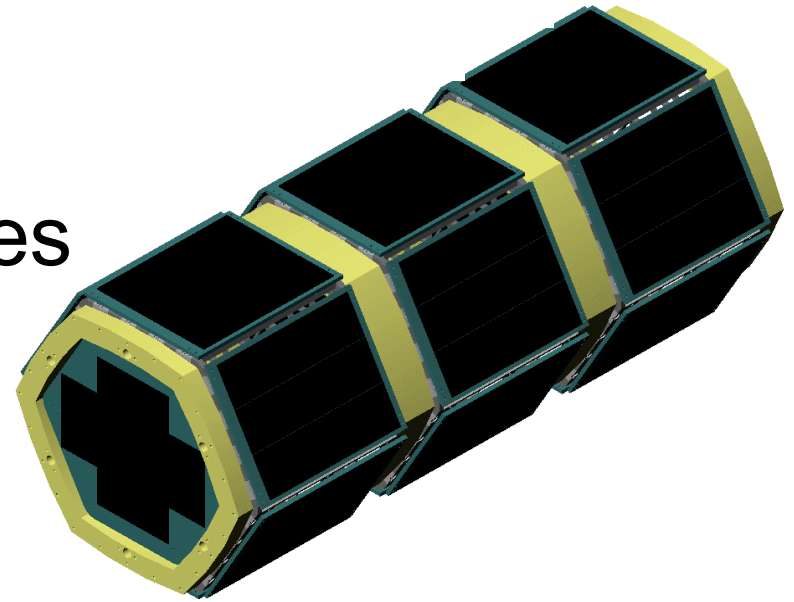
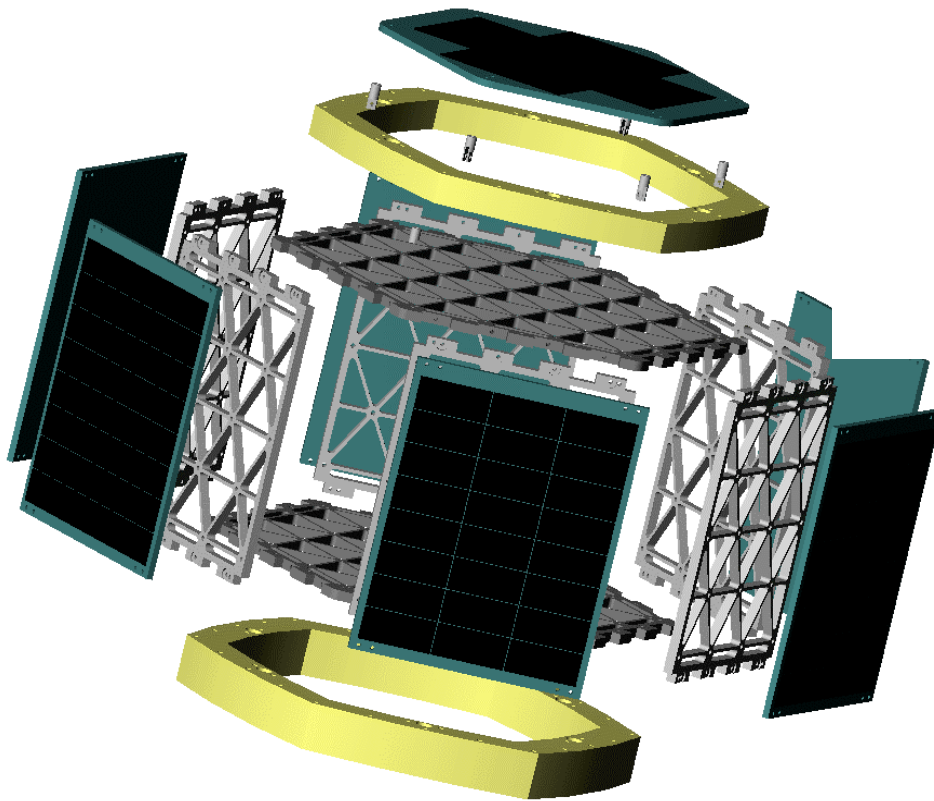


- **Low Power**
- **Low Cost**
- **Full Color**

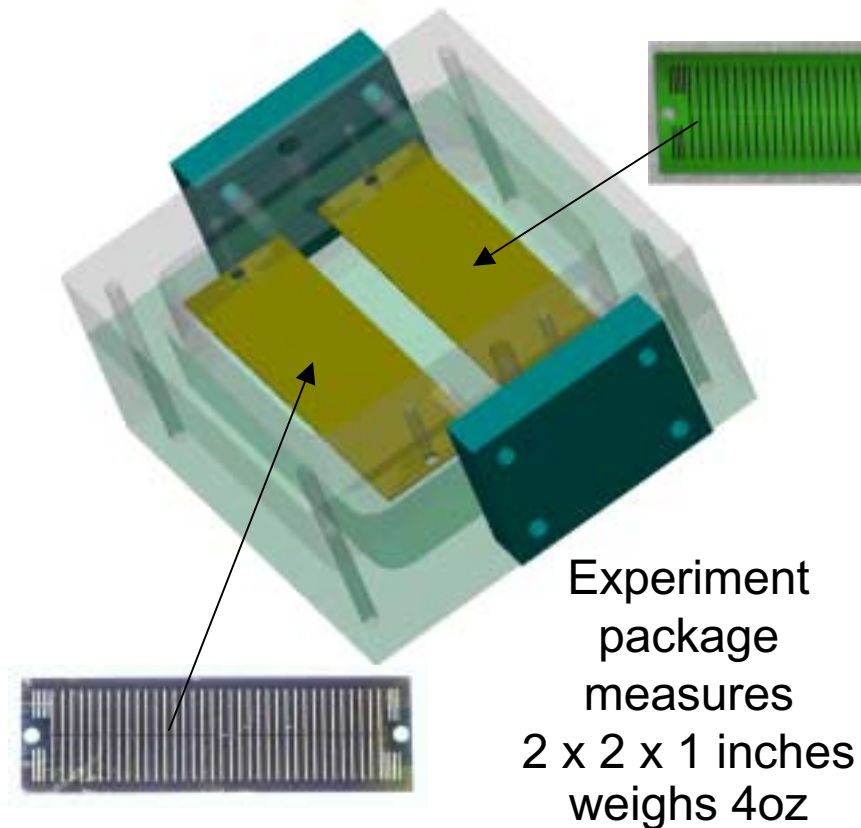


Modular, Generic Nanosatellite Design

- Iso-grid structure
- Composite-panel substrates



Free Molecule Micro-Resistojet



Experiment
package
measures

2 x 2 x 1 inches
weighs 4oz

Back side with gold coating

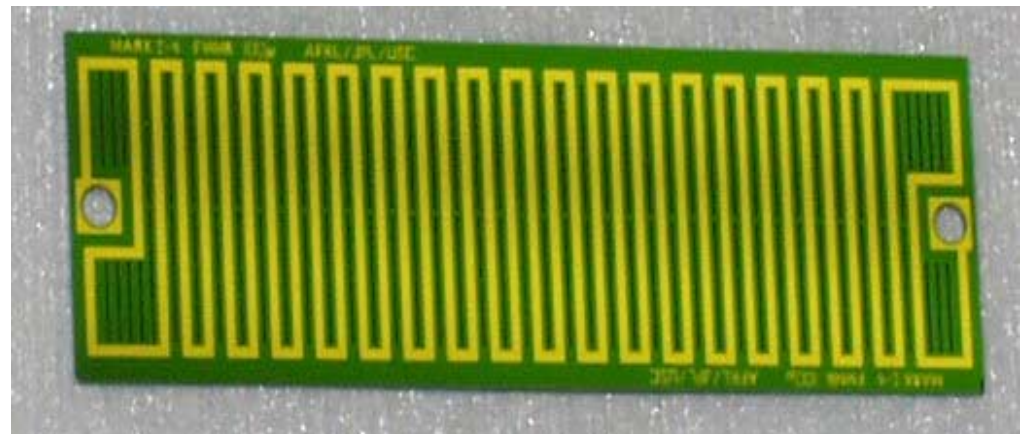
- Collaboration AFRL/USC/JPL/ASU
- Heater chip consumes 2W
- Expected surface temperature 520K (480°F)



Back side exposing silicon nitride

Chip measures 13 x 42 mm, 400 μ m thick

- Demonstration of MEMS micropropulsion heater chip in space
- Thermal experiment to improve 2nd generation FMMR design





3[^]Sat Summary

Space Shuttle Launch NET mid 2003

Phase 0/1 Safety Review June 2001

CDR with AFRL/NASA April 2001

Delivery to AFRL February 19, 2002

- Modular design
- Formation flying
- University, Industry, Government cooperation
ASU, CU, NMSU
AFRL, AFOSR, DARPA, GSFC, DoD STP, JSC
NASA Space Grant

Lockheed Martin, Boeing, Spectrum Astro, Dynamic Labs, SunCat Solar...



ASUSat Student Satellite Program

- ASUSat1 (AO-37)
 - Launched January 26, 2000
- 3^Sat (University Nanosat Program)
 - ASU, Colorado, New Mexico State
 - Expected launch: Space Shuttle 2003
- CanSat
 - Current class
- Many other projects...
 - AZeroG (KC-135)
 - Moon Devils
 - Sub-SEM

